

What is claimed is:

1. An isolated protein comprising an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8).
- 5 2. An isolated protein comprising an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10).
3. An isolated protein consisting of an amino acid sequence as depicted in Figure 5
10 (SEQ ID NO:8)
4. An isolated protein consisting of an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10).
- 15 5. An isolated protein, the amino acid sequence of which consists of a catalytic domain defined by amino acids numbers 28-380 as depicted in Figure 5 (SEQ ID NO:8) or amino acids numbers 1-353 as depicted in Figure 3A (SEQ ID NO:10).
- 20 6. A chimeric protein comprising the protein of Claim 3 fused by a covalent bond to at least a portion of a second protein, which second protein is not said protein defined by the sequence as depicted in Figure 5 (SEQ ID NO:8).
7. A chimeric protein according to Claim 6 wherein second protein is protein A and which portion is the IgG binding domain.
- 25 8. A chimeric protein comprising the protein of Claim 4 or 5 fused by a covalent bond to at least a portion of a second protein, which second protein is not said protein defined by the sequence as depicted in Figure 5 (SEQ ID NO:8).
- 30 9. A chimeric protein according to Claim 8 wherein second protein is protein A and which portion is the IgG binding domain.
10. An isolated nucleic acid comprising a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7).

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11. An isolated nucleic acid comprising a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9).

12. An isolated nucleic acid comprising a nucleotide sequence encoding an amino acid
5 sequence as depicted in Figure 5 (SEQ ID NO:8) or its reverse complement.

13. An isolated nucleic acid comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10) or its reverse complement.

10 14. An isolated RNA molecule comprising a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7), wherein the base U (uracil) is substituted for the base T (thymine) of said sequence.

15 15. An isolated RNA molecule comprising a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9), wherein the base U (uracil) is substituted for the base T (thymine) of said sequence.

16. An isolated RNA molecule comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8).

20 17. An isolated RNA molecule comprising a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10).

18. A vector comprising: (a) a nucleotide sequence as depicted in Figure 5 (SEQ ID
25 NO:7); and (b) an origin of replication.

19. The vector of Claim 18 wherein the nucleotide sequence is operably linked to a heterologous promoter.

30 20. A vector comprising: (a) a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9); and (b) an origin of replication.

21. The vector of Claim 20 wherein the nucleotide sequence is operably linked to a heterologous promoter.

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22. A vector comprising: (a) a nucleotide sequence that is the reverse complement to all or a fragment of the nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7); and (b) an origin of replication.

5 23. The vector of Claim 22 wherein the nucleotide sequence is operably linked to a heterologous promoter.

24. A vector comprising: (a) a nucleotide sequence encoding an amino acid sequence as depicted in Figure 5 (SEQ ID NO:8) and (b) an origin of replication.

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25. A vector comprising: (a) a nucleotide sequence encoding an amino acid sequence as depicted in Figure 3A (SEQ ID NO:10) and (b) an origin of replication.

15 26. A recombinant cell containing a recombinant nucleic acid vector comprising a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7).

27. The recombinant cell of Claim 26 wherein the cell is a eukaryotic cell.

28. The recombinant cell of Claim 26 wherein the cell is a mammalian cell.

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29. A recombinant cell containing a recombinant nucleic acid vector comprising a nucleotide sequence as depicted in Figure 3A (SEQ ID NO:9).

30. The recombinant cell of Claim 29 wherein the cell is a prokaryotic cell.

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31. The recombinant cell of Claim 29 wherein the cell is a bacterial cell.

32. A method of producing a rat $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:

30 (a) culturing a recombinant cell containing the vector of Claim 18 such that the $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:7 contained in said vector, is expressed by the cell; and
(b) recovering the expressed protein or a cellular fraction containing said protein.

35 33. An isolated or purified protein produced by the method of Claim 32.

34. A cellular fraction with protein activity produced by the method of Claim 32.

35. A method of producing a rat $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:

- 5 (a) culturing a recombinant cell containing the vector of Claim 20 such that the $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:9 contained in said vector, is expressed by the cell; and
(b) recovering the expressed protein or a cellular fraction containing said protein.

10 36. An isolated or purified protein produced by the method of Claim 35.

37. A cellular fraction with protein activity produced by the method of Claim 35.

38. A method of producing a rat $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:

- 15 (a) culturing a recombinant cell containing the vector of Claim 24 such that the $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:7 contained in said vector, is expressed by the cell; and
(b) recovering the expressed protein or a cellular fraction containing said protein.

20 39. An isolated or purified protein produced by the method of Claim 38.

40. A cellular fraction with protein activity produced by the method of Claim 38.

25 41. A method of producing a rat $\alpha 1 \rightarrow 2$ fucosyltransferase protein comprising:

- (a) culturing a recombinant cell containing the vector of Claim 25 such that the $\alpha 1 \rightarrow 2$ fucosyltransferase protein, encoded by the nucleotide sequence SEQ ID NO:9 contained in said vector, is expressed by the cell; and
(b) recovering the expressed protein or a cellular fraction containing said protein.

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42. An isolated or purified protein produced by the method of Claim 41.

43. A cellular fraction with protein activity produced by the method of Claim 41.

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44. A method for detecting the onset of cancer comprising the detection of a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7) or a fragment or complement thereof.

45. A method to suppress or inhibit in a cell the function of an $\alpha 1 \rightarrow 2$ fucosyltransferase protein, said method comprising contacting a cell with a nucleic acid comprising a nucleotide sequence that is the reverse complement of a nucleotide sequence as depicted in Figure 5 (SEQ ID NO:7) or a fragment thereof, or as depicted in Figure 3A (SEQ ID NO:9) or a fragment thereof, and wherein said nucleic acid is RNA, the base T (thymine) in SEQ ID NO:7 and SEQ ID NO:8 is substituted by the base U (uracil).

46. The method of Claim 45, wherein said nucleic acid is contained within an adenoviral or retroviral vector.

47. The method of Claim 45, wherein said cell is a human small cell lung carcinoma cell.

48. A method for the preparative synthesis of a molecule comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said method comprising contacting the isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and a molecule having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a molecule comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.

49. A method for the preparative synthesis of a glycolipid, glycoprotein, glycolipoprotein or free oligosaccharide comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said method comprising contacting the isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and a glycolipid, glycoprotein, glycolipoprotein or oligosaccharide having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a glycolipid, glycoprotein, glycolipoprotein or free oligosaccharide comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.

50. The method according to Claim 49 wherein the rat $\alpha 1 \rightarrow 2$ fucosyltransferase is contacted with an oligosaccharide comprising a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety.

51. A method for the preparative synthesis of fucosyl-GM₁ comprising contacting the isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 1, 2, 3, 4, 5, 6 or 8 with GDP-fucose and the ganglioside GM₁ and recovering fucosyl-GM₁.
52. A method for the preparative synthesis of a molecule comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said method comprising contacting the isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 40, or 43 with GDP-fucose and a molecule having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a molecule comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.
53. A method for the preparative synthesis of a glycolipid, glycoprotein, glycolipoprotein or free oligosaccharide comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc, said method comprising contacting the isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 40, or 43 with GDP-fucose and a glycolipid, glycoprotein, glycolipoprotein or oligosaccharide having a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety and recovering a glycolipid, glycoprotein, glycolipoprotein or free oligosaccharide comprising Fuc $\alpha 1 \rightarrow 2$ Gal $\beta 1 \rightarrow 3$ GalNAc.
54. The method according to Claim 53 wherein the rat $\alpha 1 \rightarrow 2$ fucosyltransferase is contacted with an oligosaccharide comprising a terminal Gal $\beta 1 \rightarrow 3$ GalNAc moiety.
55. A nutritional formula composition comprising the glycolipid, glycoprotein, glycolipoprotein or oligosaccharide obtained by the method of Claim 49.
56. A nutritional formula composition comprising the glycolipid, glycoprotein, glycolipoprotein or oligosaccharide obtained by the method of Claim 53.
57. A nutritional formula composition comprising the oligosaccharide obtained by the method of Claim 50.

58. A nutritional formula composition comprising the oligosaccharide obtained by the method of Claim 54.

59. A method for the preparative synthesis of fucosyl-GM₁ comprising contacting the
5 isolated or purified rat $\alpha 1 \rightarrow 2$ fucosyltransferase of Claim 33, 36, 39, or 42 or the cellular fraction of Claim 34, 37, 40, or 43 with GDP-fucose and the ganglioside GM₁ and recovering fucosyl-GM₁.

10 60. A method to induce an immunotherapeutic or immunosuppressive action against a fucosyl-GM₁-producing disease, comprising administering fucosyl-GM₁ to a human patient with said disease.

61. The method of Claim 60 wherein said disease is cancer or neurological disease.

15 62. The method of Claim 60 wherein said disease is small cell lung carcinoma.

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